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[54] **X-Y WEB TRANSLATING APPARATUS**
 19 Claims, 15 Drawing Figs.

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 [51] Int. Cl. **B41j 13/02**
 [50] Field of Search. 197/2, 3,
 82, 84.1, 84.2, 84.3, 127, 133, 133 T, 138, 138.5,
 176, 177, 178, 186; 101/114

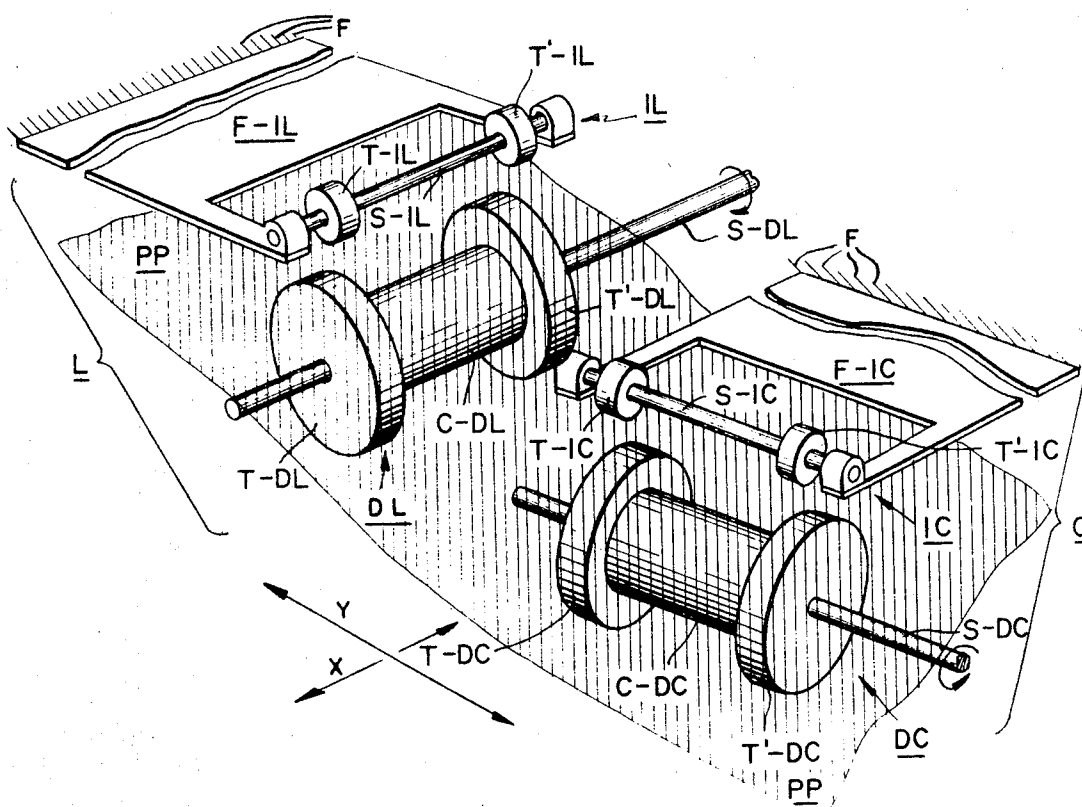
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ABSTRACT: An "X-Y" pinch roll arrangement for translating a web in two transverse directions wherein a pair of transversely oriented pinch roll assemblies (e.g. for "column-shift" and "line-shift") are adapted to cooperate in shifting a web (e.g. a printed page) in two orthogonal directions. According to related, dependent features, each such assembly may comprise one or more pinch roll sets, each set including an idler roll and a drive roll, adapted to be selectively interengaged about the web for holding it, or for translating it when the rolls are rotated; these rolls may be made magnetically "self-attracting"; each roll may comprise a plurality of spaced wheels for frictionally driving the web, and better steering it therewith; the idler rolls may be flexure-suspended; the drive rolls may be, in turn, rotated selectively by a "step motor"; the magnetically self-attracting pinch rolls may be "locked to hold" the web between incrementings thereof; the drive roll means in both pinch roll assemblies may be driven from a common source through a "right angle" coupling; and, certain pinch roll parts may be fabricated from plastic. Certain printer environments are also described and indicate advantageous employment of such "X-Y" pinch roll arrangements—these environments comprising means for mounting certain pinch roll elements together with certain printing elements (especially the lighter, more compact, passive elements) in a cantilevered arm housing, or, analogously, in an "overhanging bar" housing, either housing spanning the designated "paper path." These will also be indicated in cooperation with certain advantageous "supply means" for supplying and manipulating print webs across a double-width platen surface, such as a "free coil" length of paper, wound loosely and so to be laterally slideable in a "coil compartment" at one, or both, ends of a "double-width" platen (twice the expected web width); or such as a continuous form-feed with a slideable "form-loop" maintained between input and output storage areas for permitting relatively free translation of the intermediate web length across the "double width" platen.



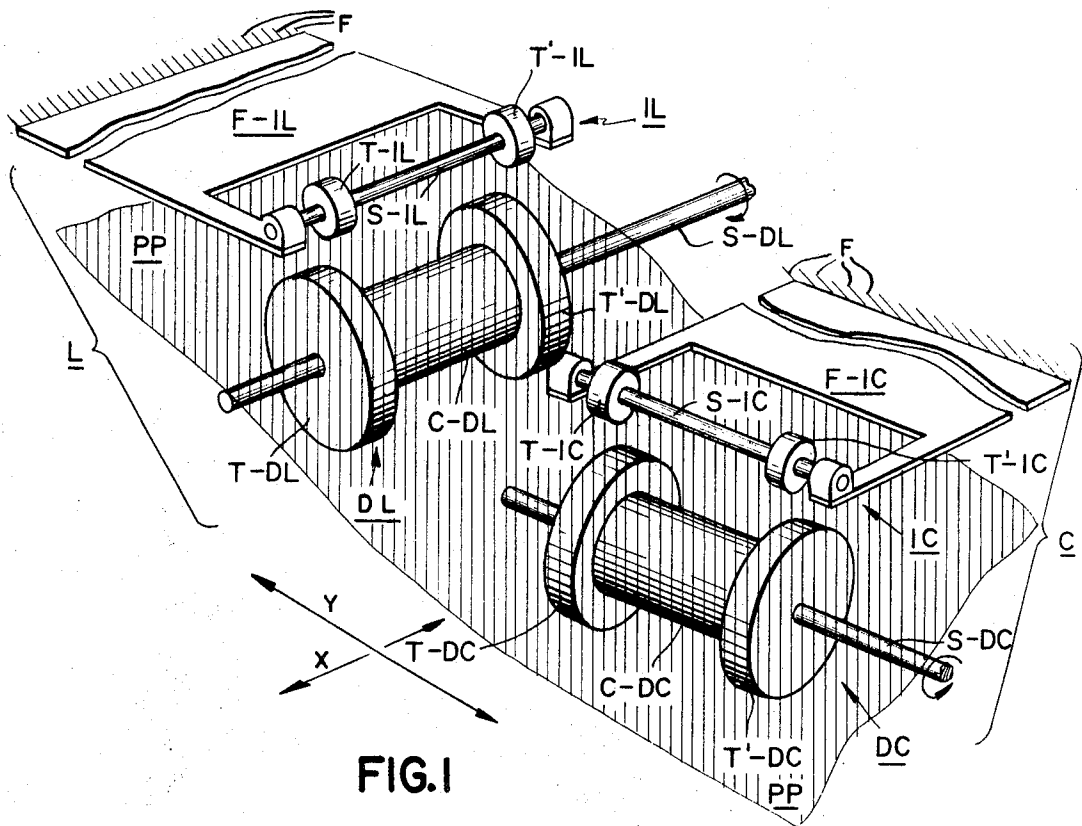


FIG. I

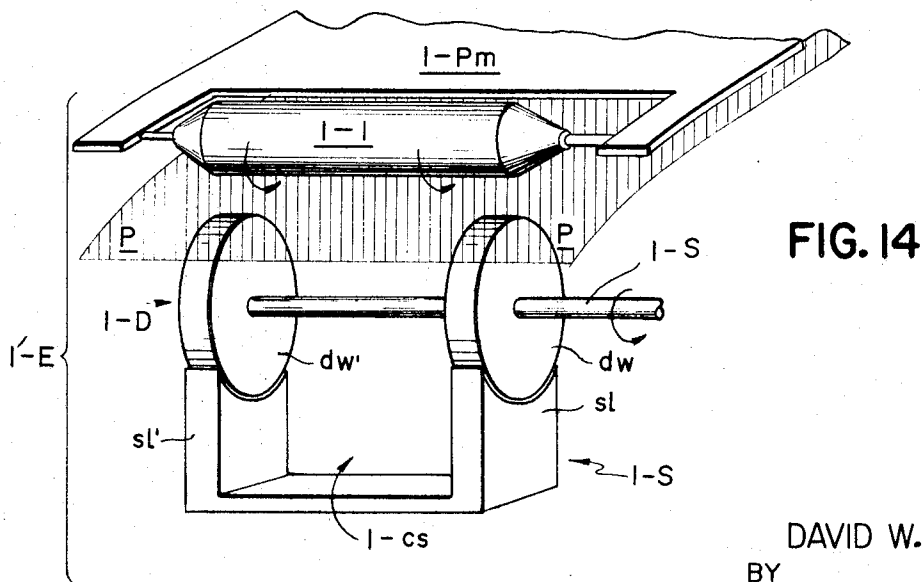
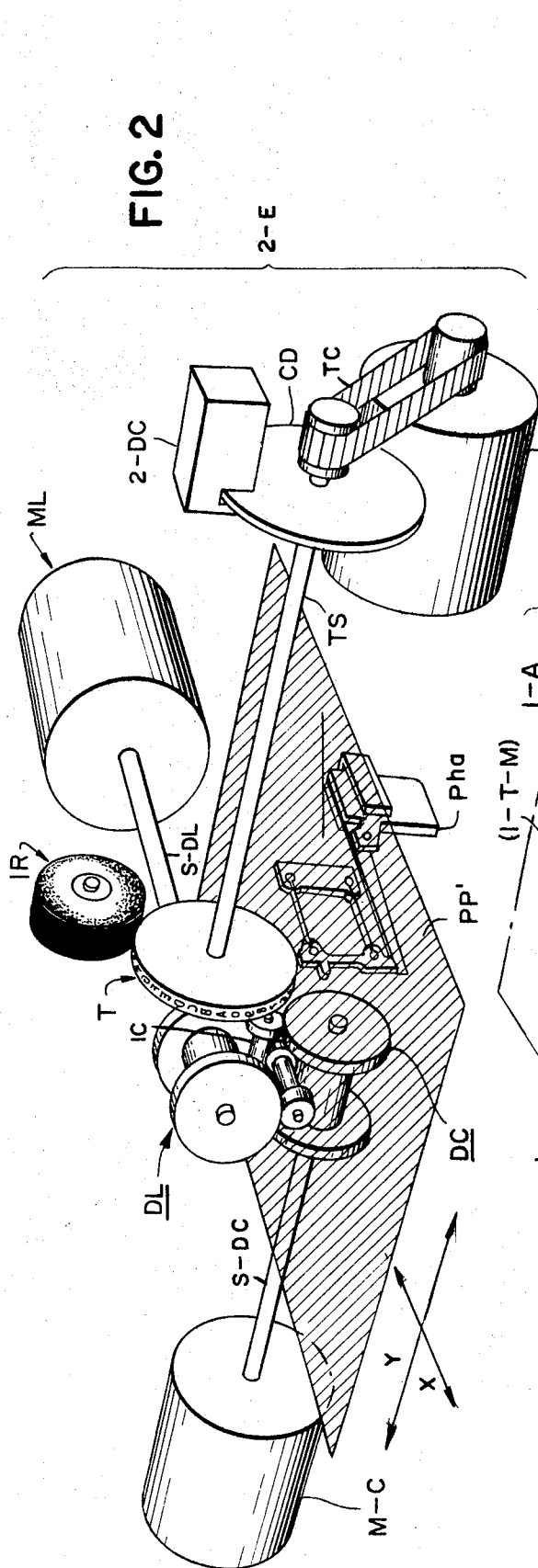
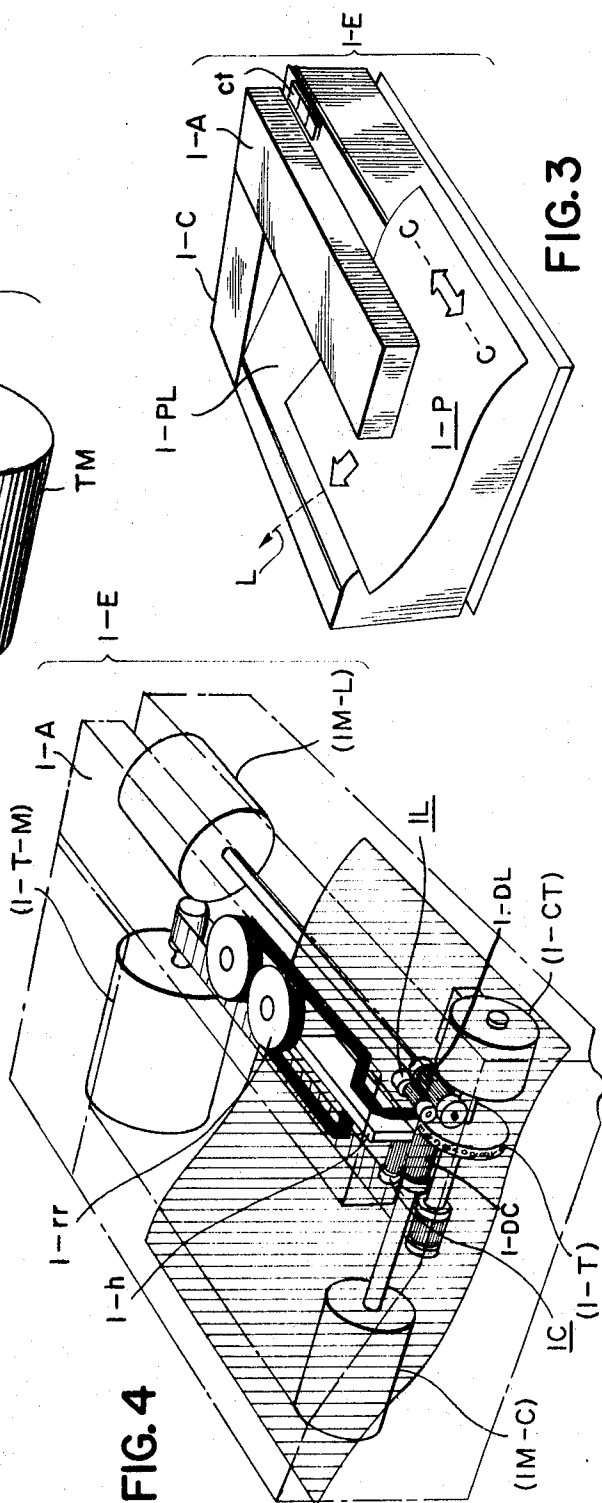
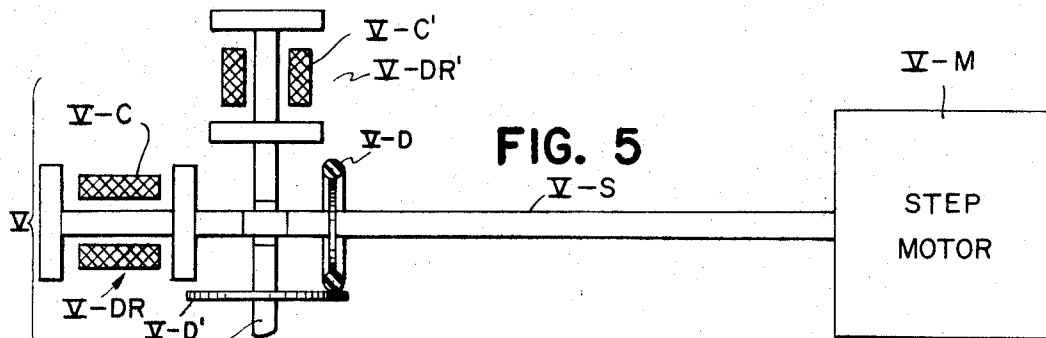
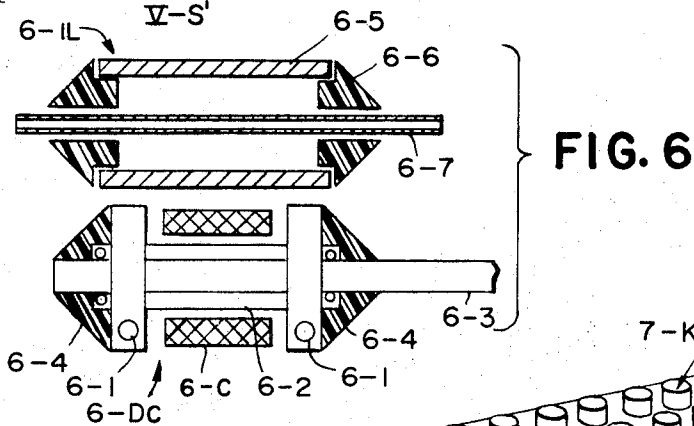
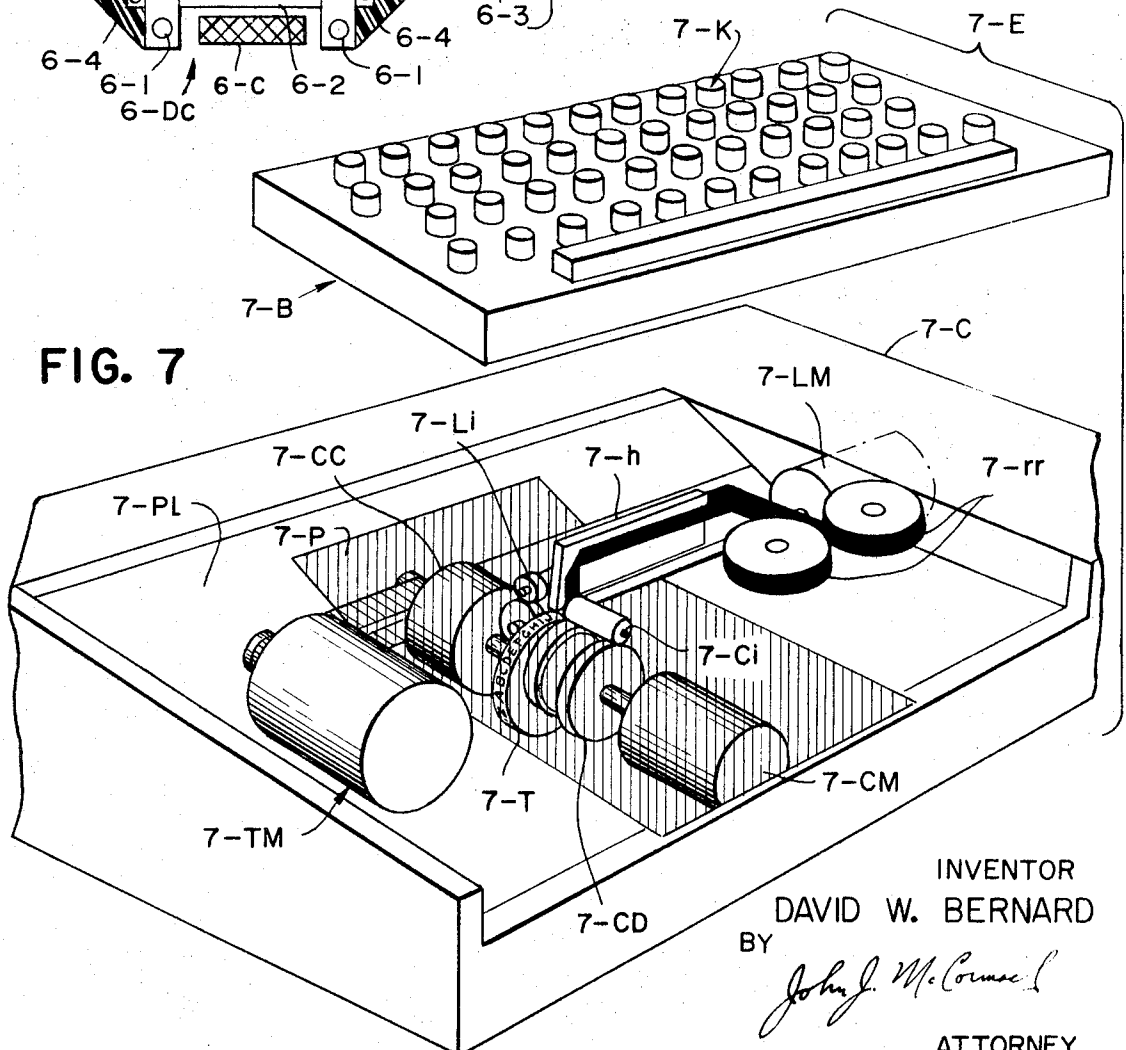


FIG. I4

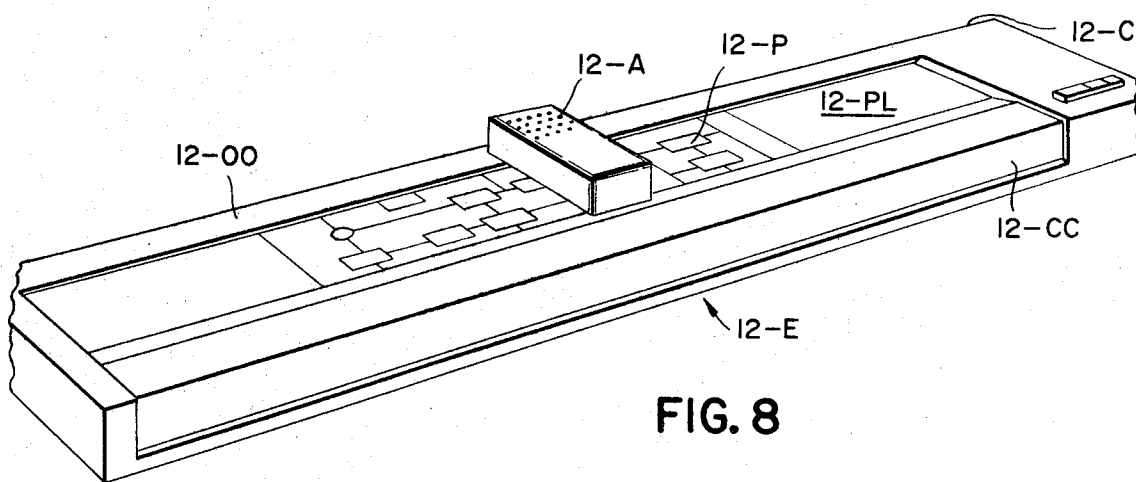
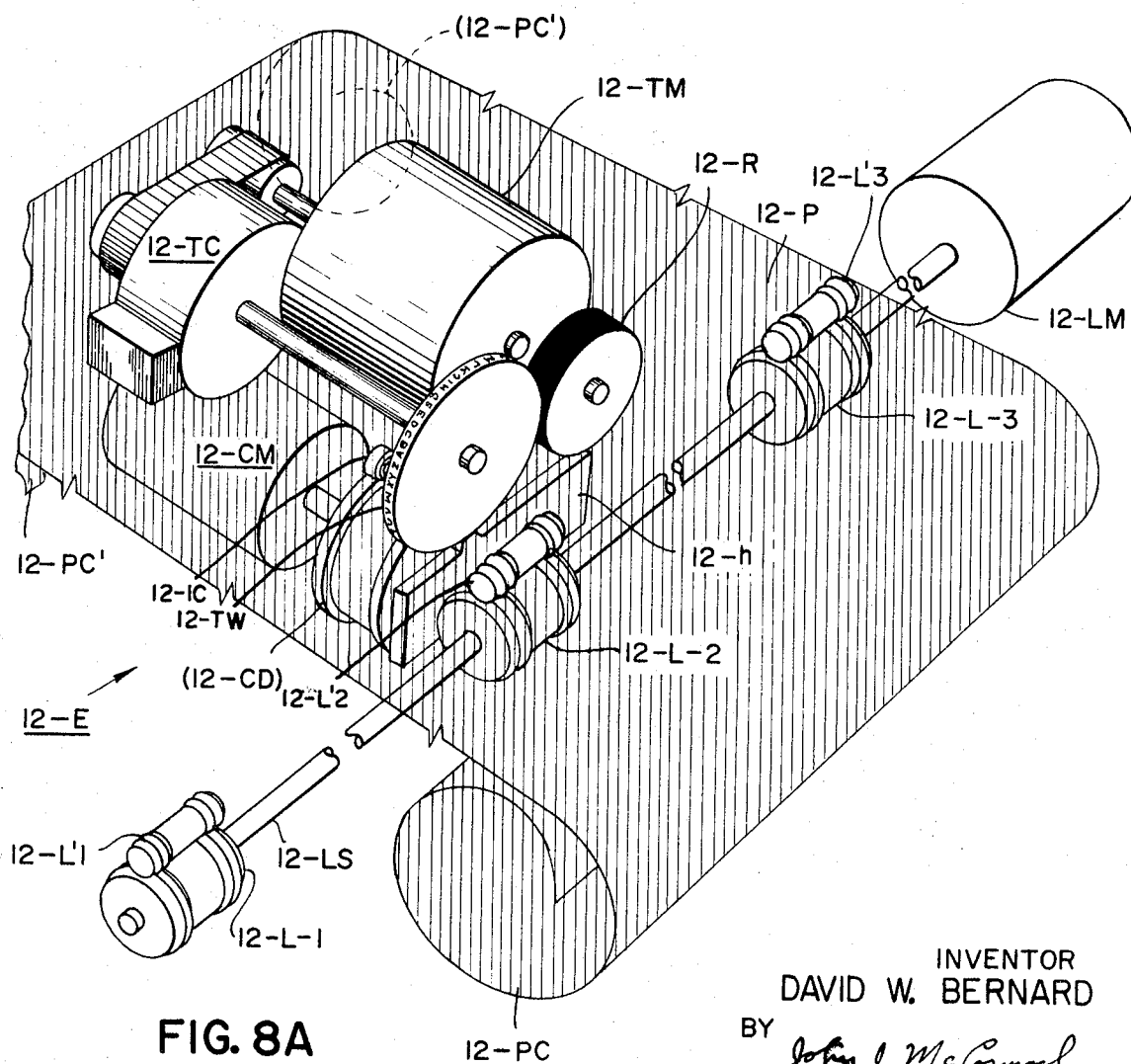
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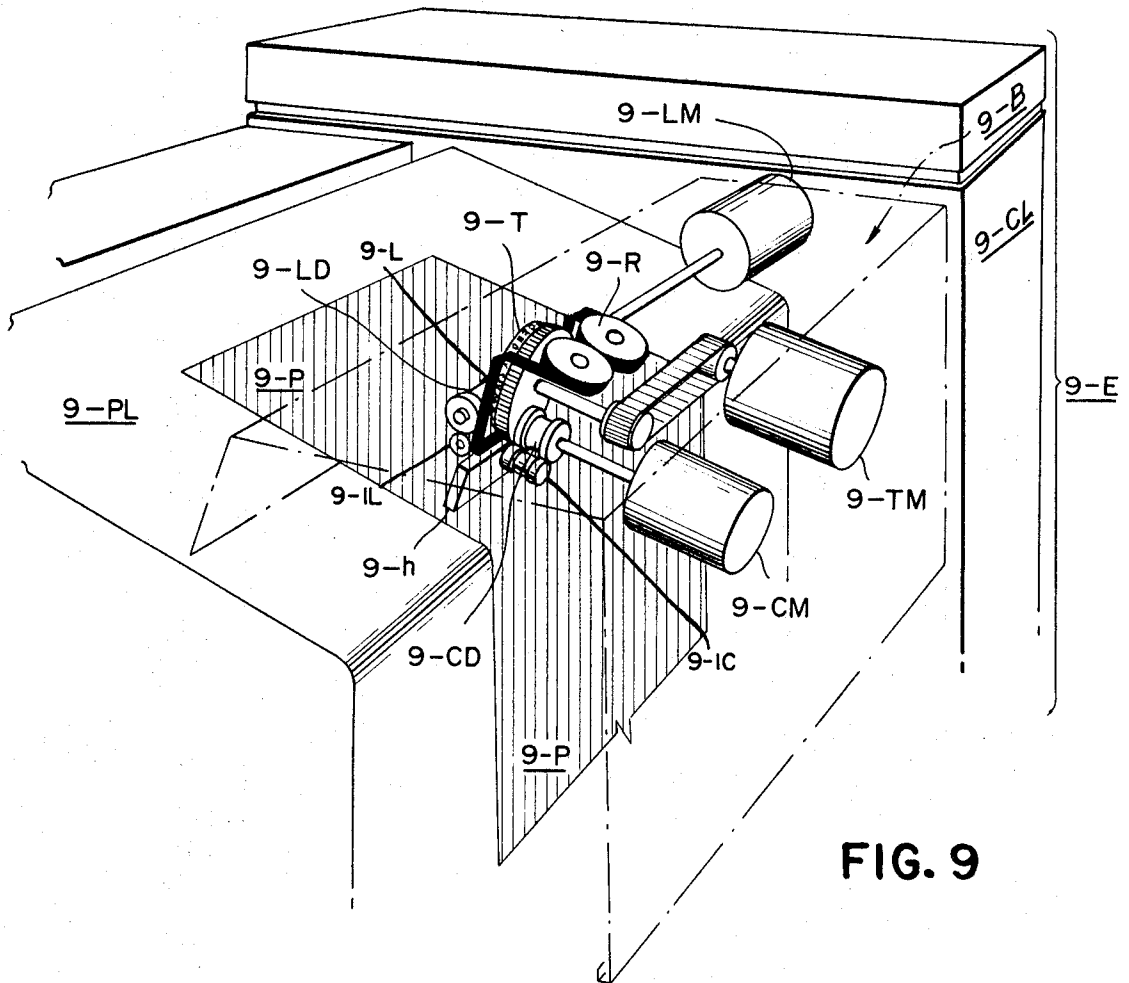


FIG. 9

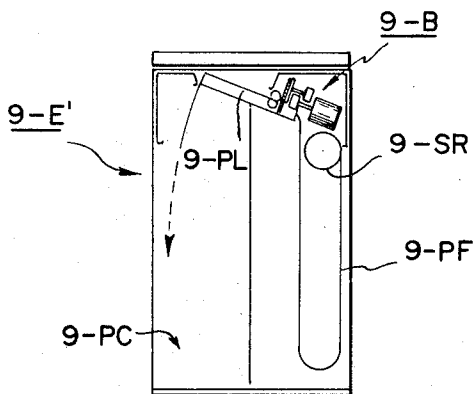


FIG. 10

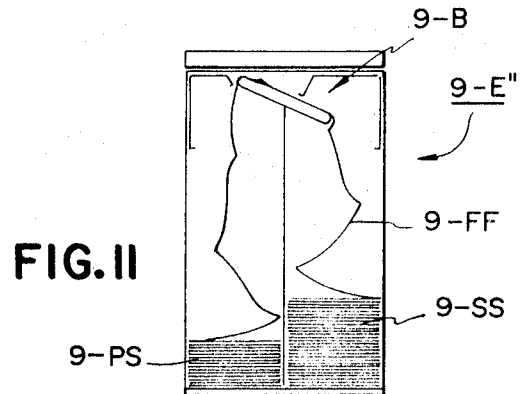


FIG. 11

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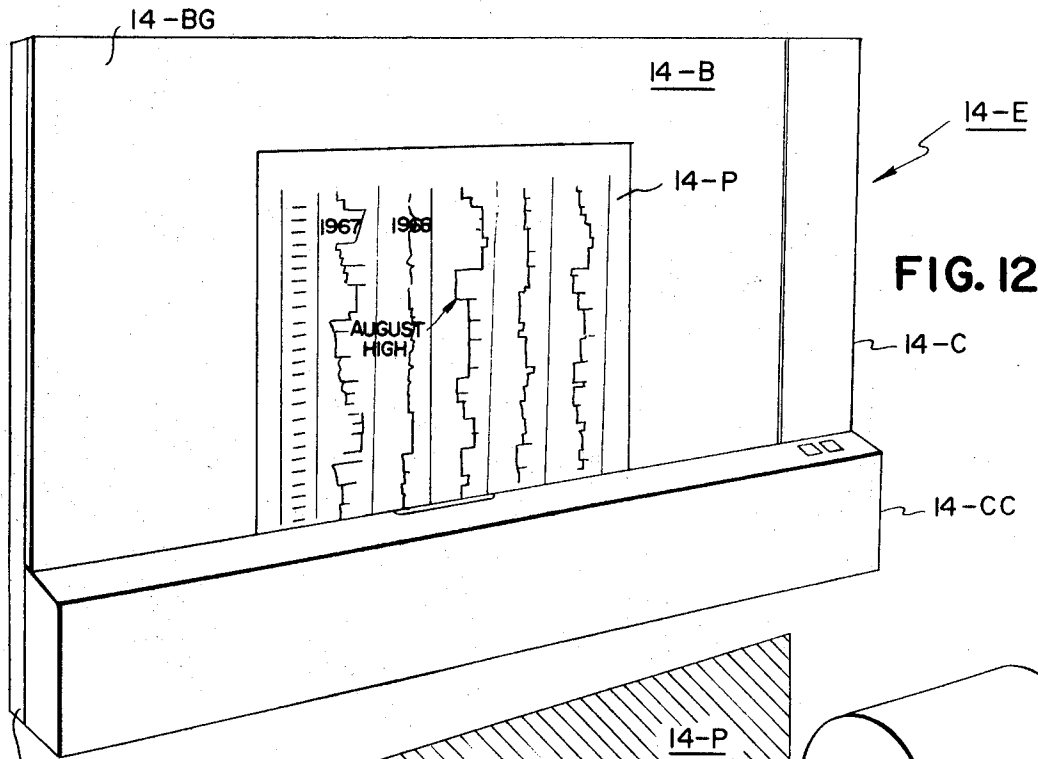


FIG. 12

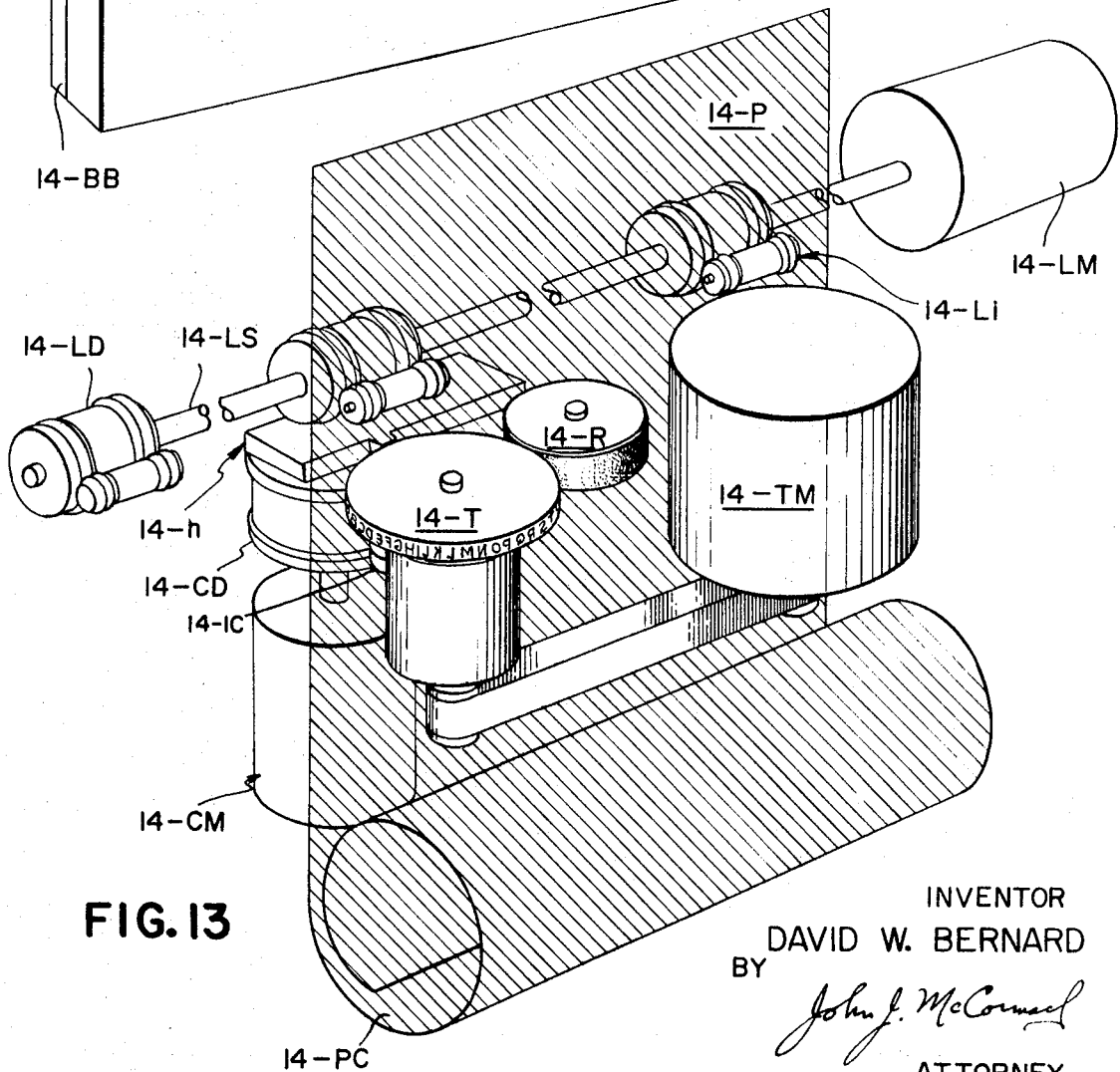


FIG. 13

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X-Y WEB TRANSLATING APPARATUS

BACKGROUND, SALIENT FEATURES

Workers in the art of designing printers are well aware that the physical size and complexity of current printing devices are among their most outstanding shortcomings, typically contributing greatly to the cost of fabrication and servicing, to the reliability limitations and to the use-limitations of today's printers. The present invention represents an effort toward simplifying and compacting printer configurations considerably and, for instance, includes features directed toward packaging printer elements so conveniently and compactly as to make it practical to design a "desktop" printer, a "wall-mounted" printer or the like. More particularly, the features according to this invention have been found capable of radically simplifying a typical "remote terminal printer" (reducing the number of moving parts therein from a typical several hundred to the order of a dozen or two), yet while being capable of printing about ten to fifteen characters per second (including carriage-return time) and being capable of printing forwards or backwards upon command—something not feasible with today's printers. Such part-reduction can allow reducing the number of moving parts on the order of 15 to 100 times.

Thus, a prime object of the invention is to alleviate such problems and provide such features and advantages. A related object is to provide improved "X-Y" web translating apparatus, especially for printer mechanisms. A more particular object is to provide such apparatus comprising a pair of "X-Y" pinch roll arrangements, each arrangement comprising respective idler and drive roll means adapted to selectively engage the web and hold it, or translate it in a particular respective direction. A related object is to make such pinch roll means magnetically self-attracting. Another object is to comprise the idler and drive roll means, each, of a plurality of friction wheels for driving the web. Another object is to flexure-suspend the idler roll means. Another object is to selectively rotate the drive roll means by "step motor means."

Other objects and various other features of novelty will be pointed out, or will occur to those skilled in the art, from consideration of the following specification in conjunction with the accompanying drawings relating to preferred embodiments of the invention.

In the drawing wherein like characters denote like elements:

FIG. 1 is a very schematic upper isometric view of an illustrative "X-Y" pinch roll arrangement according to the invention;

FIG. 2 is an upper isometric view of an arrangement like that in FIG. 1, but slightly modified and shown in operative combination with elements of a printer apparatus;

FIGS. 3 and 4 are an isometric view of, respectively, the outside and the inside of another embodiment comprising a printer apparatus somewhat modified from that of FIG. 2 together with related "X-Y" web transport means in a somewhat modified arrangement thereof;

FIG. 5 is a schematic plan view of a generally indicated pair of "X-Y" drive rolls together with a unitary drive means therefor and improved interconnecting drive couplings;

FIG. 6 is a front sectional view, somewhat fragmentary and schematic, of representative associated idler and drive roll means indicating improved fabrication techniques and materials therefor;

FIG. 7 is an upper isometric view of another printer apparatus somewhat modified from the foregoing apparatus and with a keyboard-mounting bar portion exploded away;

FIGS. 8 and 8A are upper isometric views respectively of the outer casing of a printer and of the printing and transport elements therein, shown somewhat schematically and fragmentarily, this printer apparatus being somewhat modified from the foregoing apparatus, both as to the "X-Y" pinch roll arrangements and as to the web handling means;

FIG. 9 is an upper isometric view of yet another printer embodiment including another version of the "X-Y" pinch roll arrangements and associated printing elements;

FIGS. 10 and 11 are side-section schematic showings of the apparatus in FIG. 9 together with first and second alternate web manipulating arrangements;

FIGS. 12 and 13 are front isometric views respectively of the exterior, and of interior (printing-transport elements therein), of yet another printer embodiment; and

FIG. 14 is a front isometric showing of another idler-drive roll combination functionally similar to those indicated in FIGS. 1 and 6, but modified somewhat.

CROSSED PINCH-ROLLS

Some salient features of the invention will first be explained generally, and with reference to the very schematic showing in FIG. 1 of two crossed ("X-Y") pinch-roll arrangements, the explanation then being amplified and particularized by describing the generally indicated printer environment of FIG. 2, and later further particularized by describing the remote terminal printer embodiment indicated in FIGS. 3 and 4. Thus, an initial understanding of some features of a "crossed" pinch-roll web transport according to the invention may be gleaned from consideration of FIGS. 1 and 2. In FIG. 1, an "X-Y" web transport array is schematized and will be understood to operate upon a segment of a paper web PP so as to quickly and controllably translate it in either of two transverse directions for conventional printing operations in a printer environment as understood in the art. Thus, web PP will be understood as intended to be shifted a prescribed amount in the "X" (or "print column") direction by the activation of a "column-shift" pinch-roll arrangement C, this arrangement comprising an idler assembly IC and a cooperating drive assembly DC. That is, responsive to a prescribed "column pinch" signal, a pair of rolls T-IC and T'-IC on the assembly IC and a pair of rolls T-DC and T'-DC will be thrust into engaged relation (with web PP to be firmly engaged therebetween, as known in the art). Then, the rolls T-DC, T'-DC in one of the assemblies (drive assembly DC) may be rotated a prescribed (column-shifting) amount, such as by activation of associated column motor M-C (FIG. 2) and associated drive shaft S-DC to rotate the rolls a prescribed amount (responsive to an associated "column-shift" signal applied as known in the art, etc.). Similarly, a "line shift" may be effected by an analogous line shift arrangement L comprising an idler and drive assembly (IL, DL, respectively) which will be understood as having their respective rolls T-IL, T'IL and T-DL, T'-DL engaged responsive to a prescribed (selectively applied) "line pinch" signal. Then, the rolls T-DL, T'-DL in drive assembly DL may be rotated a prescribed amount (such as responsive to an associated "line-shift signal" applied to an associated line-shift motor ML (FIG. 2) and associated drive shaft S-DL) to effect this in a known manner. Thus, a broad salient feature of the invention will be apparent whereby a pair of crossed (or transverse) pinch-roll arrangements DL, IL and DC, IC are provided for "X-Y" web translation; that is, for shifting an intermediate web PP in transverse directions by controllable amounts. This is especially useful for effecting "column-shift" and "line-shift" in a printer apparatus as seen below. Further, with each such arrangement it will be apparent that one, or both, such roll-pairs (i.e. IC/DC, IL/DL, or both) may be engaged to also "hold" the intermediate web PP firmly (e.g. during a printing operation) and that one (or both) roll-pairs DL, IL or DC, IC may also be rotated to drive the web in a respective direction (e.g. while the other roll-pair is released). Other more particular features will appear as the description proceeds.

According to another feature, the pinch-roll arrangements shown may readily be adapted for magnetic "self-attraction," such as by providing a solenoid coil on one of the engaging rolls (or otherwise projecting flux from the roll, such as indicated in FIG. 14, described below) and making the companion roll "magnetic." According to a related feature, one of these rolls is preferably adapted to be constructed and suspended very simply and compactly, e.g. like the light, flexure-pivoted idler rolls IC, IL indicated. More particularly and

with reference, still, to FIG. 1, the column shift arrangement C includes an idler assembly IC comprising an idler roll having a pair of similar pinch-roll tires (rotatable engagement surfaces—wheels) T-IC, T'-IC fixed on an associated idler shaft S-IC which is, in turn, rotatably journaled conventionally in bearing portions of a flexure strip mount F-IC, projected out from a prescribed fixed location on the machine frame F (generally indicated) and in a known manner, so that idler tires T-IC, T'-IC assume a prescribed attitude and gap relation with associated engageable drive tires (T-DC, T'-DC respectively) on the associated drive assembly DC, as known in the art. This intertire gap will, of course, be at least sufficient to accommodate a prescribed maximum form-thickness as known in the art. Drive assembly DC thus includes a drive roll with drive tires T-DC, T'-DC affixed on an associated drive shaft S-DC. Tires T-DC, T'-DC are of magnetic material and spaced apart a prescribed distance (the same as tires T-IC, T'-IC, so as to register with, and engage these), this distance being at least sufficient to accommodate an intermediate solenoid coil (as C-DC, FIG. 1). Coil C-DC will be understood as mounted fixedly (from a frame) to surround shaft S-DC between tires T-DC, T'-DC to project flux therein and is adapted, responsive to a "pinch" command, to generate a prescribed attractive magnetic flux as known in the art. The drive tires (e.g. T-DC, T'-DC) are preferably adapted to frictionally engage the paper web PP and may comprise contact surfaces of suitable metal such as smooth, flame-treated steel rollers, or (less preferably) an elastomeric surface cover or the like. The idler tires (e.g. T-IC, T'-IC) are preferably adapted to engage the web PP with a minimum of friction and provide a firm, "web-following" engagement base against which the associated drive tires T-DC, T'-DC may thrust. Being made freely rotatable to "follow" the moving web PP with minimum drag and with a low-friction surface, the idler tires T-IC, T'-IC may comprise steel rollers with a smooth, polished surface or the like.

With coil C-DC fixedly mounted to surround shaft S-DC and disposed in flux-coupling relation with (magnetic) drive tires T-DC, T'-DC and thus cause flux to be projected therefrom when a prescribed "column-engage" signal is applied to the coil C-DC (conventionally, as a current pulse through leads, not shown). This magnetic flux will be understood as sufficient to attract the cooperating associated magnetic idler tires (T-IC, T'-IC toward engagement with T-DC, T'-DC respectively) and to thereby "grip" the intermediate web. Thereafter, when a "column-shift" signal is applied to the associated motor M-C, FIG. 2, and rotates shaft S-DC, the engaged pinch rollers DC, IC will be understood as rotated sufficient to move the intermediate engaged web PP the desired amount (in the column or X direction).

The line-shifting arrangement L including idler and drive assemblies IL, DL, is constructed in a similar manner. Idler assembly IL comprises a pair of spaced magnetic idler tires T-IL, T'-IL fixed on an associated shaft S-IL which is rotatably journaled in a pivot flexure mount F-IL (projected from a fixed frame F as with F-IC). Drive assembly DL comprises a pair of magnetic drive tires T-DL, T'-DL fixed on a shaft S-DL to be rotated by an associated motor (not shown). These tires are spaced apart sufficient to be engageable with the associated idling tires and to accommodate an intermediate nonrotatable solenoid coil C-DL, magnetically coupled thereto, (as with aforementioned coil C-DC), adapted, when energized, to effect a projecting flux to attract the respective idling tires (as with coil C-DC).

According to another salient feature, these column-shifting and line-shifting arrangements are adapted to each be controllably driven by motors M-C and ML (FIG. 2) which may be characterized as "step motor" drive means, that is, an incremental electrical (powered and controlled) rotary drive, such as a motor by way of example the Model H-S-50 precision stepping motor manufactured by Superior Electric Company. Such a motor will be understood as one effective to selectively increment the aforementioned drive tires a prescribed

amount. Step motors are quite apt for use with selectably attractable pinch-roll arrangements like those described, such as in a printer or like environment, where the pinch-rolls can at times be engaged in a stationary condition to simply "hold" the intermediate web, while at other times they can be activated to drive the web in their respective directions; further, at still other times they may be disengaged to allow another companion pinch-roll to translate the web. Moreover, step motors like the foregoing also typically exhibit such advantageous (for the instant applications) characteristics of compact size, lightweight, low cost, reliable operation, direct digital control (by drive pulse and without need for feedback control); noncumulative error; no preferred "home" position (as opposed to conventional servos and synchros, although these may be substituted in certain cases, or even added to the step motor—e.g. as feedback control for self-checking, etc.), large starting and holding torque; rapid acceleration and deceleration (without clutch or brake); low rotor moment; inherent low speed and low cost. For example, in an apparatus of the type illustrated in embodiment 2-E (FIG. 2) motors M-C, ML were of the type described above, having the operating characteristics of: 40–80 in.-oz. torque; relatively high inertia and torque/inertia rating; a step angle of about 7°–10° (at about 50 steps/sec.). The motors ML, M-C may, of course, be of any similarly suitable type such as a 50 in.-oz Warner step motor by Warner Company.

This feature may be better understood with reference to the generally indicated printer embodiment 2-E in FIG. 2 which is conventional, except where noted. Here a raised-font type wheel T (comprising one, or several, columns of raised font) is rotatably fixed on a shaft TS to be presented in prescribed printing relation with paper at a prescribed paper-plane PP'. Shaft TS is conventionally journaled in a fixed frame (not shown in FIG. 2 to more clearly reveal the operative elements) and adapted to be rotatably driven, such as by type wheel motor TM (and the indicated timing belt coupling TC), in a prescribed conventional manner. A conventional code disc CD and associated photocell detector 2-DC may also be provided to conventionally decode and indicate the passing type font on wheel T as known in the art. A print-hammer-actuator arrangement Pha is mounted together with its associated solenoid actuator (not shown) so as to selectively impact an intermediate paper segment fed into the plane PP' against the surface of type wheel T at times corresponding to the passage of a selected type character (in a manner well known in the art). Of course, inking means should be conventionally provided for such a printer arrangement and a particularly apt one comprises a porous Nylon ink roll IR filled with ink fluid and arranged, as known in the art, to wipe its inking surface rotatably against the passing surface of type wheel T.

Although printer 2-E is schematized here, with some of the more conventional elements being omitted for clarity (but readily understandable to those skilled in the art), it will be apparent that it offers a rather novel approach to the arrangement of printing elements, associated transport elements, etc. In the construction of one embodiment in accordance with the present invention, a printer was devised which moves only the paper, rather than the heavy print carriage (as is typical in the art) with many consequent advantages observed. For instance, less than 20 moving parts were required here; where comparable prior art printers require on the order of from about 500 to about 1800 moving parts. Satisfactorily fast printing was nonetheless achieved (about 10 to 15 characters per second, including carriage-return time), and the machine could print backwards as well as forwards (if properly "buffered"); where other serial printers cannot do so (they must "backspace" twice for each character when printing in reverse). Also, the paper web was "pinch-held" to prevent motion during printing. Printing was done "on-the-fly" with a line printer actuator and hammer of conventional construction, being controllable through a standard interface with paper tape or a keyboard. Those skilled in the art will especially appreciate the advantage of being able to "pinch-hold" a form during printing

and to thereafter quickly step the paper (with the same print-rolls) to the next position, with very little delay.

According to other features, one or both pinch-roll arrangements comprises a "multitired" construction whereby each pinch roll shaft mounts two or more spaced tires, engageable with associated tires in the foregoing manner. Thus, two or more sets of engaging (idler-capstan) pinch-roll tire combinations may be aligned along a particular shaft, spaced apart somewhat and adapted to cooperate in holding, or in translating, the intermediate web. Of course, the embodiments of FIGS. 1 and 2 illustrate one form of this feature, wherein the "column-shift" and "line-shift" pinch-roll assemblies C, L each, include two such pairs of engaging tires (e.g. spaced apart to accommodate the intermediate solenoid coil on the drive roll etc.). Such a "multitired" feature is related to the aforementioned step-motor feature and will be evidently advantageous in providing a "multipoint" contact between the pinch-rolls and the web; for instance, acting to grip paper webs more positively as well as to drive them more unidirectionally and in better alignment, without skew. For instance, the solenoid-controlled "pinch-holding" effect has been observed to be so effective, in the printer embodiment 2-E of FIG. 2, that activation of both solenoids into the "pinch" condition held the paper web so firmly it was impossible to manually move or withdraw the web without tearing it! Of course, in some instances, it will be advantageous to use more than two pairs of "pinch-roll tire sets in-line," such as for greater traction over a larger paper span, as indicated in embodiments 12-E and 14-E which will be described in detail below. Of course, another advantage of such multitired pinch-rolls, with space being provided between engaging tires, is that a solenoid coil may be mounted between the tires on a common shaft (as described above). Also, both pairs of two-tire pinch-rolls may be "crossnested" in the fashion indicated in FIG. 2. It will be evident that when such a "nesting" is feasible, it can act to greatly compact the pinch-roll package and can also position the pinch-rolls so that both of the translation-axes (column-shift and line-shift) intersect at a common point. A disadvantage may be that, where the drive rolls are magnetized by a solenoid coil (as in FIG. 2—rather than externally for instance), space considerations will prevent one from driving both assemblies from above the plane PP' or below the plane PP'.

According to another feature of the pinch-roll drive arrangement may comprise a single common drive means with a transverse (90°) "crosscoupling" between the arrangements. That is, where separate column-shift and line-shift step motors were indicated for the respective arrangements in the embodiments of FIGS. 1 through 4, it will be possible (and advantageous in certain instances) to use a single step motor (or the like) to directly drive one of the pinch-roll arrangements, while being coupled to also drive the other indirectly (through suitable coupling means). For instance, as indicated in embodiment V in FIG. 5, a single "step motor" V-M of the type aforementioned may be used to controllably rotate drive shaft V-S and the (line-shift) arrangement including capstan V-DR thereon in the manner, for instance, of the driving arrangement DC in embodiment 2-E above. Of course, capstan V-DR may translate an associated idler roll as IC, of FIG. 1 (e.g. when the associated solenoid V-C is energized). A "column-shift" capstan arrangement V-DR' is also schematically indicated as affixed on a respective shaft V-S' (rotatably journaled in a fixed frame, not shown), and disposed below shaft V-S and adapted to be selectively engaged with an associated idler roll as IL of FIG. 1 (for instance, when the associated coil V-C' is energized).

These drive shafts V-S, V-S' include a respective transverse coupling means V-D/V-D' affixed thereon and presenting a pair of friction rings in coupling relation so that the rotation (by motor V-M) of shaft V-S and coupling V-D thereon will synchronously rotate coupling V-D' (coupled to V-D for rotation thereof, as known in the art), and to thereby rotate shaft V-S' and the pinch-roll arrangement mounted thereon.

Workers in the art will visualize that as an alternative to the friction ring type coupling V-D/V-D' a belt-coupling means, such as a twisted timing belt (which is preferred for most cases) or an "O" belt; a gear coupling (e.g. helical or bevel); a friction ball/disc drive (e.g. with a rubber tire) a "planetary" drive or the like may be used to couple the shafts V-S, V-S'. The shafts V-S, V-S' will be understood as continually rotated in synchronism, although their relative speeds may vary (e.g. the gear ratio of one to the other can be adjustable through coupling changes as understood in the art—e.g. introducing various gear ratios, etc.). Thus, for instance, to column-shift a paper web, coil V-c would be energized to engage column-shift capstan V-DR with its respective idler; and thereupon motor V-M would be activated to rotate the prescribed incremental amount. Thereafter, if desired, a line-shift could be effected by release of the column-shifting idler and engagement of the line-shift capstan V-DR' with its associated idler (by energization of associated coil V-C') so that activation of motor V-M would rotate these rollers the prescribed incremental amount (through couplings V-D, V-D').

Workers in the art will recognize that although certain disadvantages may accrue in such a modification, the saving of one motor and associated drive means, controls, etc.; plus a saving in space, related costs, etc. may well justify the addition of the indicated coupling means and toleration of certain endemic limitations.

According to an optimization feature, certain elements of "crossed" pinch rolls, such as those aforementioned, may be very apt for construction with plastic materials, thus, improving convenience, reducing cost, etc. For instance, as rather schematically indicated in FIG. 6, certain elements of an exemplary idler/capstan set as generally depicted by DC, IC or DL, IL in FIGS. 1 and 2 (6-IL, 6-DC respectively) may be so constructed, being like the foregoing pinch-roll sets, except where noted. That is, idler roll 6-IL may comprise a pair of spaced plastic hubs 6-6 affixed (e.g. press-fit) on a fixed idler shaft 6-7 (e.g. of metal tubing) and adapted to receive a tubular magnetic sleeve 6-5, hubs 6-6 closing the opposite ends of sleeve 6-5 and being adapted to act as bearing surfaces for sleeve rotation. Hubs 6-6 may comprise "Nylon," "Delrin" or a like "bearing plastic" material and should be adequate for many applications, since, when so arranged, they will be subject to light loads only (such as the weight of the magnetic restoring force) and should not present significant problems, except under very high repetition rates (stepping frequencies). Of course, shaft 6-7 may alternatively be made rotatable.

Workers in the art will appreciate that various other roll magnetizing means may be substituted, at times, for the solenoid coil means indicated for the arrangements in FIGS. 1, 2 and elsewhere. One such magnetizing means is indicated in alternate pinch roll embodiment 1'-E of FIG. 14, according to another feature. Here, an idler roll 1-1 is mounted on an associated pivot mount 1-Pm to be in magnetic, operable relation with an associated drive roll 1-D so that with flux projected from the registering, spaced magnetic tires dw, dw' of the roll 1-D (on drive shaft 1-S), roll 1-1 will be engaged with these and an intermediate web P, and web P be translated upon rotation of the roll 1-D as aforementioned. These elements may be understood as constructed and operated in the manner indicated for FIG. 1 except where noted. However, here, the flux-generating solenoid coil is wound on a separate magnetic spool 1-S to project working flux along a pair of spool legs sl, sl' and, thereby, through magnetic tires dw, dw' , respectively to attract magnetic idler 1-1 in the foregoing manner. Thus, legs sl, sl' are constructed and arranged to efficiently pass coil flux to respective tires dw, dw' , confronting tires dw, dw' respectively about a prescribed sectorial portion of their periphery, spaced a minimum flux conserving gap therefrom, as known in the art. This "external coil" configuration will be appreciated as allowing location of the coil away from the drive shaft, intertire area while still using the magnetic character of the tires to convey the working flux.

Similarly, drive roll 6-DC may comprise a pair of magnetic discs 6-1 (e.g. iron washers or the like) affixed on associated drive shaft 6-3 by clamping between an internal tubular magnetic hub 6-2, affixed to a rotatable shaft 6-3, about which a magnet coil 6-C is disposed (for projecting magnetic flux to attract idler 6-1L in the manner aforementioned). Each disc 6-1 is affixed on shaft 6-3 against the ends of spacer tube 6-2 by a respective (snap-on) plastic fitting 6-4 attached to shaft 6-3 and preferably chamfered on the surface opposite the disc 6-1 in the indicated manner.

MACHINE ENVIRONMENTS

It will be apparent to those skilled in the art that the aforementioned (and other related kinds of) "crossed" ("X-Y") pinch roll arrangements, including one or several of the aforementioned refinement features, may be incorporated as a web-translating portion of various web-handling machines, such as the paper feed for various paper marking machines (e.g. plotters, listers, and, especially, printers). Various embodiments of such machines will now be described and FIGS. 3 through 14 referred to by way of illustrating various advantageous applications for such "crossed" pinch-roll arrangements, as well as indicating other machine features advantageously coacting therewith. All printing and transport elements indicated below in these machines will be understood as like their aforescribed counterpart except as noted.

Accordingly, embodiment 1-E is shown in FIGS. 3 and 4 as indicating an advantageous application of a "crossed" pinch-roll arrangement according to the invention. This will be appreciated as a page-printer embodiment that rather advantageously provides an arrangement of printing and paper feed elements so as to offer minimum obstruction over the print-page as it is advanced through the printer; as well as the advantages of simple construction, the ability to see a line almost immediately after it is printed and very convenient access to parts for repair and replacement. More particularly, in FIG. 3, embodiment 1-E will be understood as comprising a remote terminal printer wherein a top surface portion of the casing 1-C comprises a paper-receiving platen surface 1-PL adapted for receiving a page 1-P to be printed. Printer 1-E also includes a control panel *ct* and a novel "projecting arm" structure 1-A, effective, according to a feature here, to house the upper printing-transport elements, (i.e. those not enclosed within the body of casing 1-C and beneath platen 1-PL). Platen 1-PL is curved up at the rear simply for operator convenience, easy visibility of the printed lines, etc. and, of course, may take many other convenient configuration, such as being completely flat (as in the case, for instance, of embodiment 12-E described below). As will be more apparent in FIG. 4, arm 1-A, being cantilevered out over the page-receiving platen 1-PL (i.e. over the paper path), is adapted to house a few of the print-impacting and page-translating means so as to print on the page in a controlled manner, while translating it in the column-and-line-directions (i.e. directions C-C, L respectively).

Thus, as indicated in FIG. 4, taken in conjunction with FIG. 3 the body of casing 1-C houses most of the translating and impacting elements; (especially the larger and heavier ones, shown in phantom and understood to be underneath the illustrated page 1-P) namely a type wheel 1-T, plus its associated motor 1-T-M and code means 1-CT; as well as a column-shift motor 1M-C and its associated drive roll 1-DC; plus a line-shift motor 1M-L and its associated drive roll 1-DL (these all being understood by those skilled in the art as structurally and functionally analogous to the comparable elements indicated and described for the embodiment of FIG. 2, though being somewhat differently arranged here). Indeed, all elements here are constructed and operate like those aforementioned except as noted. It will be observed, however, that, according to this feature of the invention, projecting arm 1-A is preferably adapted to contain only those elements necessary

to be superposed over the page 1-P, the lighter more compact elements being preferred for optimum "packaging" convenience, of course. Thus, a set of conventional print ribbon rolls 1-rr and associated ribbon-directing means as is shown in the art are schematically indicated (being presented in impact relation with type wheel 1-T) as mounted in arm 1-A, as is print hammer assembly 1-h, adapted to be selectively actuated in the well-known manner. Also, mounted in arm 1-A are a column-shift idler roll IC and a line-shift idler roll IL, these being arranged so their respective registering tires may be selectively interengageable (e.g. responsive to energization of an associated solenoid coil on the respective drive rolls 1-DC, 1-DL mounted beneath the platen 1-PL).

It will be recognized that mounting the heavier, larger and more cumbersome capstans (and the like), together with their associated solenoid coils, in the base of machine 1-E, while, on the other hand, disposing the lighter, more compact and simpler (passive) idler rolls (and the like) in cantilevered arm 1-A will have obvious advantages in producing a more convenient, more practical printer machine "package". Workers in the art will discern other advantages here; especially those associated with the novel arrangement of the platen 1-PL on the top surface of a compact printer machine. (Of course, it may be preferred to mount the type wheel etc. above the page rather than as shown in some cases, e.g. for clearer printing). Illustrative of the compact, convenient packaging of these elements in printer 1-E is the fact that representative dimensions of this machine will be an overall height on the order of one-half foot and cross-sectional dimensions on the order of 1 foot by 2 feet. The dimensions of the platen surface 1-PL will, of course, be adequate to accommodate maximum contemplated lengths of pages 1-P and double their maximum widths (i.e. a "double-width" platen so that pages could be translated across 1-PL in the column direction, C-C, across their entire width). Thus, the hammer assembly 1-h is here cantilevered out across platen 1-PL at least the entire width of the "largest-width page" which is contemplated. Pages may, of course, be manually inserted in such a printer, quite readily. Only the mechanical components are understood as housed in the indicated printer, the power and logic elements being located elsewhere (such as in the associated data processing system).

Workers in the art will appreciate that this embodiment effects a compacting of many elements, such as in the array of "crossed" pinch-rolls, with idlers mounted in the cantilevered arm, along with the hammer and ribbon feed elements. The overall printer is so compacted as to provide a genuine "desktop" printer, susceptible of readily printing upon a top-surface platen in the indicated manner. The paper 1-P may, of course, be allowed to project beyond the outer edge of the platen 1-PL as it prints to the end of a line. Such a "desktop" printer may be used as a remote terminal printer in a data processing system or other advantageous arrangements. Workers will appreciate the advantageous "packaging" of printer elements whereby the paper transport is kept simple and straightforward and is also advantageously arranged above and below the platen, with all the heavy motors, coil-roll assemblies, type wheel etc. hidden away beneath the platen in the base of casing 1-C, while a minimum of necessary printing and transport elements are housed in the projecting arm 1-A (e.g. the light, flexure-mounted, self-attracting idler rolls IC, IL). The operation of printer 1-E will be apparent to those skilled in the art and proceed in the aforescribed manner. For instance, when "pinch signals" are applied to energize the solenoid coils (presumably mounted about the capstans) to attract pinch rolls IC and IL into paper engagement (e.g. through one of the control switches on panel *ct*, applying current to the coils—leads not shown), the page may be firmly "held" (e.g. for printing), or be translated, selectively.

While the foregoing embodiment 1-E illustrates one advantageous technique whereby transport and printing elements may be arranged and packaged within printing and similar marking devices, others will occur to those skilled in the art, such as those described below with reference to em-

bodiments 7-E, 9-E, 12-E and 14-E (in FIGS. 7-14). For instance, these embodiments will suggest other advantageous arrangements for the crossed pinch-roll paper feed feature, as well as arrangements for associated printing/transport elements. Moreover, these will also indicate other related systems for supplying and handling paper webs either in the form of pages (or like discontinuous sheets), or as continuous rolled stock, such as forms wound on a spool. As a result, it will become apparent that the novel paper transport and associated printing elements according to the invention provide a new degree of freedom in supplying and handling paper stock of widely varying widths and lengths. Moreover, while embodiment 1-E above indicates one advantageous application where certain of the transport and printing elements are packaged in a "cantilevered arm" structure to project over the paper platen, workers will appreciate other ways of implementing this feature, such as indicated below in embodiment 12-E. Also, a somewhat different, though related, packaging arrangement will be taught below, whereby printing and transport elements are housed in a structure superposed over the paper platen takes the form of an "overhanging bar", such as illustrated in embodiments 7-E or 9-E.

Thus, embodiment 7-E in FIG. 7 will be understood as representing a console printer comprising a casing 7-C, including a top, curved, platen surface 7-PL whereon paper webs may be supported; plus an "overhanging bar" housing 7-B superposed over the platen to house keyboard elements plus a portion of the printing-transport elements (much in the manner of the projecting arm 1-A in embodiment 1-E, though somewhat modified). Bar 7-B is, of course, quite solidly supported, on both sides, by casing 7-C and advantageously forms a top operating platform (e.g. for keyboard 7-K or the like) as well as housing certain printing elements. That is, bar 7-B houses hammer actuator assembly 7-h, ribbon rolls 7-rr and the transport idler rolls (i.e. roll 7-Li, for line-shift, and roll 7-Ci for column-shift). These and other elements will be understood as the same as in the foregoing embodiments, except where noted. Casing 7-C, on the other hand, houses the remaining print-transport elements; namely: a type wheel 7-T and its associated motor 7-TM and encoder 7-CC; plus a column-shift motor 7-CM and associated drive roll 7-CD (with solenoid for engaging the corresponding idler 7-Ci), etc. plus a line-shift motor etc; LM and associated drive roll for coaction with idler 7-Li—all, generally, in the manner of the foregoing embodiment 1-E. A particularly advantageous form of this console printer is its use as an input-output terminal device providing a communications link with a computer central processor to produce hard copy responsive to data signals (conventionally transposed into printer and transport control signals as known in the art), i.e. printed output in the form of printed sheets 7-P. The keyboard 7-K is conventional (it may be a compact solid state device, as known in the art) and may serve both to control the terminal printing at this console and to provide a data link with the central processor.

FIGS. 9, 10 and 11 indicate, rather schematically, a continuous-form printer embodiment 9-E which may be characterized as a free-standing, self-fed remote printing terminal which (unlike the prior embodiments) includes sufficient cabinet space for its own power supplies, logic modules, etc. (in compartment 9-CL of the printer frame). One feature of this embodiment is that most of the printing-transport elements are housed in an overhanging bar, or housing compartment, 9-B, somewhat similar to the bar 7-B in embodiment 7-E, performing, however, a somewhat opposite role, namely housing the majority (not the minority) of these elements. Housing 9-B may be made movable, such as to "swingout" pivoting on the printer frame so as to provide access both to the paper and to operating elements in the housing 9-B. These elements are thus arranged to be suspended over the "double-width" web-supporting platen 9-PL and the paper web 9-P transported across the platen 9-PL in two "X, Y" (column and line) directions. Thus, only a minimum of printing and transport elements (such as hammer-actuator assembly 9-h

and the idler rolls 9-IL, 9-IC) need be mounted here beneath platen 9-PL—i.e. only those needed to define transport-loci and printing-loci with cooperating elements in bar 9-B. Ribbon rolls 9-R and the associated ribbon 9-L are arranged somewhat modified here; however, the other elements in housing 9-B may be understood as constructed and operating essentially like those in the foregoing embodiments, these elements being the same except where noted. Thus, bar 9-B houses a type wheel 9-T and its associated drive motor 9-TM, together with a line-shift motor 9-LM and its associated driving roll 9-LD, plus a column-shift motor 9-CM together with its driving roller 9-CD (where, before, such elements were located in a machine base).

Another feature of embodiment 9-E is the manner in which the continuous forms are supplied and manipulated so as to be susceptible of two-dimensional transport (column-shift and line-shift as with the prior embodiments); something unusual in the printing of continuous forms! Thus, a "continuous roll" paper feed arrangement is indicated schematically in FIG. 10 (essentially, a sectional side view of printer 9-E) wherein paper is unspooled continuously from a supply roll 9-SR to be carried across platen 9-PL and into a chamber 9-PC as indicated by the arrow of FIG. 10 (that is, line-shifted and to be also column-shifted in the transverse direction, both by the indicated crossed pinch-roll embodiments as shown in detail in FIG. 9). A long intermediate web loop 9-PF is maintained by conventional means, such as with a drive motor rotating spool 9-SR and controlled to maintain a loop of a prescribed length (much in the manner of conventional magnetic tape feed systems in the magnetic recording arts). It will be evident that such a paper-feed may be adapted to permit sufficient free lateral movement (column-shift) across platen 9-PL. The platen 9-PL must be "double-width," i.e. wide enough to accommodate this and at least twice as wide as the largest expected form-width. An alternative "fan-fold" paper feed arrangement is indicated in FIG. 11, wherein a supply of fan-fold forms 9-SS is indicated as adapted to be translated across platen 9-PL and stored on the opposite side, i.e. stacked in the indicated stack 9-PS. A "loop" 9-FF may also be maintained here (by conventional form-traction and control means, not shown).

FIGS. 8 and 8A indicate a large-sized paper printer/plotter embodiment 12-E exemplifying some of the cantilevered arm characteristics of embodiment 1-E and the "double width" platen feature of embodiment 9-E, together with other novel features including a novel "slideable web-coil" paper feeding arrangement, as well as a novel elongate "multiple pinch-roll" feed arrangement. Thus, plotter 12-E may be understood to be constructed and operated like the foregoing embodiments except as noted and includes a casing 12-C, including an "in-feed" compartment 12-CC and a "double-width" platen 12-PL, across which a length of plotting paper 12-P of prescribed width is adapted to be translated (by a modified version of the "crossed" pinch-roll arrangement according to the invention). Also, certain of the printing/column-shifting elements are housed centrally beneath platen 12-PL (as indicated in FIG. 13), while other, cooperating elements are housed in a "projecting arm" housing 12-A projected to hang over the printing and column-shift loci in the manner of the foregoing "projecting arm" structures, though being modified somewhat. At the other (output) side of platen 12-PL is a paper supply compartment 12-00, similar to the input supply compartment 12-CC though not typically requiring any transport (e.g. spooling) arrangement. Thus, a column-shift motor 12-CM and its associated drive roll 12-CD are mounted beneath platen 12-PL, together with a print hammer actuator assembly 12-h; while in projecting arm 12-A are mounted the complementary elements: namely, type wheel motor 12-TM and its associated driven type wheel 12-TW and encoder assembly 12-TC, together with an operatively associated ink roll 12-R (generally similar to roll IR in FIG. 2), as well as an idler roll 12-IC adapted for cooperative engagement with column-shift roll 12-CD. These elements, of course, will be

understood as functioning in the manner of the foregoing similar embodiments.

Here, however, the paper supply arrangement, while being somewhat similar to that indicated in FIGS. 9 and 10 is modified so that rather than being supplied simply in the form of a document of limited length (or a paper-sheet) the medium to receive printed characters is provided in the form of a relatively long, but unspooled web 12-P. Web 12-P is functionally indicated in FIG. 8A and adapted to be loosely coiled (of "in-coil 12-PC") in in feed compartment 12-CC initially, with its markable section projecting under arm 12-A, and arranged to be transported across platen 12-PL to be thrust into out-feed compartment 12-OO. Web 12-P is preferably guided into compartment 12-OO to be loosely coiled (self-coiling "out-coil" 12-PC'), yet slideable in the column direction (column-shiftable). Thus, as will be appreciated by those skilled in the art, a relatively long document, such as typically desired in a plotter, may be handled by this arrangement rather conveniently and will exhibit the transport-freedom of a single document (e.g. as with the page 1-P in FIG. 3); while also having the storage convenience of the coiled or fan-fold continuous fed paper in FIGS. 10 and 11. For instance, it is contemplated that a typical web 12-P would comprise a web about 2 feet wide and about 3 feet long. With the two parallel edges of the sheet thus constrained to coil themselves automatically in the space within tubular compartments 12-OO and 12-CC, the overall height of the plotter 12-E is greatly reduced and its construction is greatly simplified (e.g. by being not required to provide infeed or out-feed apparatus for the paper).

According to a related feature, the line-shift pinch-roll arrangement is modified to accommodate such a paper web and web-handling arrangement by being displaced somewhat from the locus of the column-shift assembly. That is, these roll pairs are housed in compartment 12-CC and comprise an elongate shaft 12-LS adapted to be controllably driven by an associated motor 12-LM, with a plurality of regularly spaced drive rolls 12-L-1, 12-L-2, 12-L-3 etc. fixed thereon (under the plane of the paper in the manner of the aforementioned similar drive rolls, such as DC in FIG. 2) plus a set of registered mating idlers 12-L'1, 12-L'2, 12-L'3. The line-shift array also preferably includes magnetic attracting means for selective "roll-pinching" as before. This elongate line-shift array of pinch rolls is thus arranged across the "paper path", i.e. the locus of possible transit of the paper as it is pulled from in-coil 12-PC across platen 12-PL, while also being column-shifted across a transit-width on the order of double the maximum form-width in the manner like that of embodiment 9-E. The complementary idler rolls 12-L'1 etc., of course, are mounted in spaced, engageable registering relation, each above a respective one of these drive rolls so that, with the paper form passing therebetween and the pair of pinch rolls magnetically, or otherwise, engaged (such as indicated in the foregoing embodiments), rotation of shaft 12-LS will serve to line-shift the paper in the aforementioned manner. Idlers 12-L'1 etc. may conveniently be flexure-pivoted from the top of compartment 12-CC in a conventional manner, or be mounted by any other conventional means, as understood in the art.

Workers in the art will recognize that a unique apparatus results from these features, providing a printer/plotter that can produce charts, graphs, lists, diagrams and schematics on large sheets of paper and arrangements designed to handle the paper and to transport it in a unique advantageous manner, as well as to provide an advantageous compact packaging of the required elements. The addition of a magnetically controlled marking stylus would, of course, enhance its capabilities (e.g. for drawing horizontal and vertical lines) and may supplement or replace the indicated print hammer, type roll, etc.

FIGS. 12 and 13 indicate somewhat schematically, a display-printer embodiment 14-E adapted to generate wall charts and the like and embodying some of the characteristics of plotter 12-E, though being somewhat modified. The print-

ing and paper handling elements in this embodiment will, except as noted, be understood to be constructed and operated similar to those in embodiment 12-E (and the preceding embodiments where applicable). Thus, printer 14-E comprises a housing 14-C including a display panel portion 14-B, a backing compartment 14-BB and an operating compartment 14-CC, adapted to store a sheet of paper in a loosely coiled form, as well as to house the printing and paper transport elements (in the manner of embodiment 12-E, generally). Thus, a prescribed length of paper 14-P is adapted to be injected in loosely coiled form (indicated by "in-coil" 14-PC) in a tubular storage portion of compartment 14-CC to be freely slideable, laterally (for column-shift) and with its initial length projecting up past the printing and transport elements to be printed or otherwise marked and be transported incrementally laterally (for printing a line) and lengthwise (for pulling the sheet up along panel 14-B) and for displaying successive line-marking operations (e.g. lines of printing, plotting, etc.).

Thus, compartment 14-CC houses, on one side of the paper path, the type wheel 14-T plus its associated encoder and motor 14-TM and cooperating ink roll 14-R, together with a column-shift idler roll 14-IC and an elongate array of idler rolls 14-Li spaced across the width of panel 14-B (understood as double the maximum form width as with embodiment 12-E) and adapted to preform the "line-shift" function in the manner indicated for embodiment 12-E above. On the other side of the "paper path" are arranged the other cooperating transport and printing elements; namely a print-hammer-actuator assembly 14-h in operative relation with type wheel 14-T; also a column-shift motor 14-CM and associated drive roll 14-CD cooperatively engaging the aforementioned column-shift idler roll 14-IC opposing it; as well as a line-shift motor 14-LM and an associated set of drive rolls 14-LD on shaft 14-LS to be in registered selectively engageable relation with respective idler rolls 14-Li, in the manner of the foregoing embodiment 12-E.

According to this feature, display panel 14-B will be understood as double-width (i.e. at least twice as wide as the maximum chart form) and high enough to accommodate the maximum height chart display, while being comprised of a pair of spaced walls, between which a printed chart 14-P is adapted to be guided (as it is thrust upward by pinch rolls 14-Li, 14-LD in compartment 14-CC). This, panel 14-B comprises an outer transparent wall 14-BG (e.g. of Plexiglass or the like) spaced from the inner, backing wall 14-BB, just sufficient to admit chart passage (e.g. typically about one-sixteenth inch). This space is preferably open at the top of panel 14-B and at least one side to allow insertion and removal of the charts conveniently. Embodiment 14-E comprises a variation of the plotter 12-E aforementioned and can provide a continuous display of information as it is printed (or charted, drawn etc.) on a chart, diagram, map etc. The machine is obviously nicely compacted, especially in the depth dimension (i.e. normal to the paper plane) and indeed may be narrow enough and light enough for convenient "wall mounting" or the like.

Those skilled in the art will recognize that the foregoing embodiments have taught a number of new and unobvious features quite advantageous for application in indicated printers or similar environments. It will be seen that novel crossed "X, Y" pinch roll arrangements have been taught for translating webs (sheets of paper) in two directions, doing so in a very efficient, carefully guided manner and requiring a minimum of simple, readily available parts. Such web-transporters have also been taught as very advantageously adapted for a "web-hold function"—something quite useful in the art! Various refinement features of such "crossed pinch roll" arrangements have been taught, such as in FIGS. 1 through 6; while various applications in printers, etc. have also been taught, such as in embodiments 1-E, 7-E, 9-E, 12-E and 14-E. Similarly, it will be recognized that various other related arrangements for supplying and manipulating paper webs have also been taught, such as in the aforementioned printer and plotter embodiments. Of

course, workers in the art will recognize that these arrangements may be modified within the skill of the art and/or be combined with other different environments while still practicing the invention taught.

While in accordance with the provisions of the patent law, the above has illustrated and described preferred forms of the invention and their modes of operation, it will be apparent to those skilled in the art that changes may be made in the apparatus described without departing from the spirit and scope of the invention as set forth in the appended claims and that in some cases certain features of the invention may be used to advantage without a corresponding use of other features, while certain features may be changed or substituted for, equivalently, as appreciated by those skilled in the art.

Having now described the invention, what I desire as being claimed and to be secured by Letters Patent is:

1. An X-Y pinch roll arrangement for selectively translating a web along respective transverse shift directions, comprising; first pinch roll means for translating said web in a first direction and second pinch roll means for translating said web in a direction transverse to said first direction, said first pinch roll means including a drive roll for contacting a surface of said web and being operatively connected to motive means for rotation thereby, an idler roll pivotally suspended in spaced relation with said drive roll and in registration therewith for contacting the opposite surface of said web to force said web into engagement with said drive roll, and magnetic means associated with said drive roll for generating a magnetic flux having a magnitude to attract said idler roll into gripping engagement with said drive roll.
2. A pinch roll arrangement as set forth in claim 1 wherein said idler roll is pivotally suspended by flexure mounting means.
3. A pinch roll arrangement as set forth in claim 1 wherein said second pinch roll means includes a second drive roll for contacting a surface of said web and being operatively connected to motive means for rotation thereby, a second idler roll pivotally suspended in spaced relation with said second drive roll and in registration therewith for contacting the opposite surface of said web to force said web into engagement with said drive roll, and magnetic means associated with said second drive roll for generating a magnetic flux having a magnitude to attract said second idler roll into gripping engagement with said second drive roll.
4. The combination as recited in claim 1 wherein said pinch roll and said idler roll comprise a pair of roll tires, each said pair being so disposed to produce said gripping engagement.
5. The combination as recited in claim 4 wherein said pinch roll means are arranged in a paper marking apparatus to translate prescribed paper webs along a prescribed paper path and transverse thereto, selectively, and also to "hold" said webs firmly; said motive means comprising incrementing drive means for rotating said drive tires a prescribed amount; and wherein said idler tires are mounted in association with certain marking elements in an overhanging housing projected across a marking portion of said paper path.
6. The combination as recited in claim 5 wherein said idler tires are suspended from flexure pivot mounting means.
7. The combination as recited in claim 6 wherein said paper path is defined over the top of said apparatus; and wherein said idler tires and associated marking elements are mounted in said housing and so projected over said paper path atop said apparatus as to present a minimum obstruction over the paper thereon.
8. The combination as recited in claim 7 wherein said apparatus comprises a "desktop" printer including a "double width platen" for supporting paper pages thereon, and being further provided with an arm housing superposed over a minor

portion thereof to define a prescribed print station.

9. The combination as recited in claim 6 wherein said apparatus comprises a printer including a double width platen portion defining said paper path and wherein said idler tires and associated marking elements comprise paper shift and printing elements housed in an overhanging bar compartment superposed over said platen portion.

10. The combination as recited in claim 9 wherein said bar compartment is supported on both sides by a frame of the printer and is arranged to support a printer control panel on a top surface of the printer.

11. The combination as recited in claim 9 wherein said idler tires are mounted under said double width platen portion of the printer and wherein cooperating drive tire and associated elements as well as printing elements are mounted in said bar compartment to project across and span a print-line portion of said platen portion.

12. The combination as recited in claim 11 wherein said web is a continuous form, said web being fed across said platen portion along said path by said pinch roll means.

13. The combination as recited in claim 12 wherein is additionally included "buffer loop" means arranged to maintain a free, unrestrained feeding portion of said web upstream of said print-line locus.

14. The combination as recited in claim 9 wherein said bar compartment is arranged at the input end of said platen portion to provide a "free-coil" compartment for elongate coiled lengths of paper forms; and is further arranged to present said printing elements and said pinch roll means on respective opposing sides of said paper path along a print-line portion thereof.

15. The combination as recited in claim 20 wherein said apparatus comprises also a "double width platen" across which elongate paper form lengths may be translated by said first pinch roll means in a first direction; said first pinch roll means comprising an elongate "double width" drive shaft arranged adjacent an input end of said platen to span the associated double width paper path, along a print-line locus, and including a plurality of magnetic drive tire pairs spaced regularly therealong; wherein is further included a plurality of idler tire pairs disposed in operable, magnetically attractable registry with respective drive tire pairs on the other side of said paper path; paper marking means arranged about said path at a print station portion of said print-line locus; and said second pinch roll means being arranged on opposite sides of said paper path adjacent said print station portion for shifting said paper form lengths in a second direction, transverse said first direction.

16. The combination as recited in claim 15 wherein said apparatus is arranged to handle elongate unitary form lengths and further includes coil compartment means arranged at the start of said paper path to define an enclosure within which said firm lengths may be coiled prior to beginning said transport along said first direction, and being double the form width to accommodate said web translation in said second direction; said first pinch roll means being disposed in said coil compartment means so as to be centered symmetrically about the print station portion.

17. The combination as recited in claim 16 wherein certain of said marking means and one of said second pinch roll means are arranged in a projecting arm housing atop said double-width platen and projected over said platen to define said print-station portion without appreciably obstructing the path.

18. The combination as recited in claim 16 wherein said platen comprises a display panel.

19. The combination as recited in claim 20 wherein said magnetizing means comprises a solenoid coil wound upon a magnetic spool means and arranged to be selectively energized to project a prescribed magnetic flux; and also flux coupling means arranged to direct said flux from said spool means to said idler roll.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,583,540 Dated June 8, 1971

Inventor(s) David W. Bernard

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 14, lines 32 and 65, the claim reference numeral "20", each occurrence, should read -- 1 --.

Signed and sealed this 2nd day of May 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents